



## Noriyuki Kasahara, M.D., Ph.D.

Immunogenetics Laboratory Associate Director

### CONTACT INFORMATION

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### RESEARCH INTERESTS

1. Development of novel and improved viral vectors for gene therapy
2. Use of therapeutic genes encoding secreted proteins in standard vector systems  
(primary focus on gene therapy for cancer, and collaborative projects on other hereditary and acquired disorders, including dermatologic, musculoskeletal, pulmonary, and gastrointestinal diseases)
3. Development of viral vectors targeted to specific tissues or cell types
4. Development of adenovirus-retroelement hybrid vectors
5. Development of tumor-selectively replication-competent retrovirus vectors
6. Development of strategies for genetic immunomodulation of stem cell-derived transplants

With few exceptions, clinical gene therapy trials have found significant shortcomings in all standard vector systems and a significant lack of therapeutic efficacy, in large part due to the inability of these standard vector systems to achieve efficient gene delivery *in vivo*. My own experience in the fields of retrovirology and gene therapy dates back almost 20 years, and my lab has established expertise in many of the major virus-based vector systems in current use, including retrovirus, lentivirus, adenovirus, and adeno-associated virus (AAV) vectors. For the past 10 years, my lab has served as a vector core facility, first for the Liver Center and Norris Comprehensive Cancer Center at USC (1996-2002), and now for the CURE Digestive Disease Research Center and Jonsson Comprehensive Cancer Center at UCLA (2003-present).

My main philosophy has been that, in order to make the most rational use of these various vector systems currently available, one should have first-hand experience with their characteristic advantages and shortcomings, so as to be able to select the most optimal vector for a given purpose. In general, using these conventional vector systems, our primary approach has been to try to compensate for their relatively low efficiency *in vivo* by using them to deliver genes encoding secreted proteins as therapeutic agents (**Research Area 1**). Thus, even if only a relatively small number of cells is successfully transduced in the body, greater therapeutic efficacy can be achieved by local or systemic secretion of the therapeutic proteins.

As an integral part of my approach toward optimizing the use of conventional gene delivery vectors for therapeutic applications, I have invested considerable effort in reaching out to clinician colleagues and establishing meaningful collaborations so that we pursue translational strategies that could eventually be clinically practical and useful. In these collaborations, my lab has generally played a critical role in providing enabling technologies for gene delivery that



have allowed us to test and optimize strategies applied to specific genes and specific disease models developed by our collaborators.

In my own laboratory, the bulk of research in progress focuses on the development of novel viral vectors that have potential to improve the efficiency, specificity, and therapeutic efficacy of gene delivery, particularly for application to cancer. Thus, another important reason for having first-hand experience with different conventional vector systems is that this comparative knowledge is essential for rationally developing any novel vector that seeks to supplant currently available vectors, which will also serve as the gold standards for comparison with the newly developed vectors.

Through projects initiated and developed in my lab, we have now created novel cancer cell-targeted virus vectors (**Research Area 2**), hybrids of different viruses (**Research Area 3**), and tumor-selectively replicating viruses (**Research Area 4**). My general approach has been to develop, validate, and perform initial *in vitro* and *in vivo* testing of these novel vectors in various cancer models in my own lab first, and subsequently to recruit basic and clinical collaborators in order to augment any technical limitations in our own expertise and to pursue further testing of our new vectors in more sophisticated disease models (e.g., orthotopic, metastatic) in a clinically relevant manner.

Recently, we have also initiated a new direction of research into the genetic modification of stem cells, including adult hematopoietic stem cells, as well as adult and embryonic pluripotent stem cells, to enhance histocompatibility and prevent rejection of allogeneic stem cell-derived transplants (**Research Area 5**). My approach here has been to learn from our increasing knowledge regarding the mechanisms that tumors employ to evade, suppress, and tolerize themselves to the immune system. Thus, we are seeking to apply the same strategies to reduce the immunogenicity of stem cell-derived tissue grafts by genetic modification.

## HISTORY & EDUCATION

<b>High School</b>	Tokyo Gakugei University High School, Tokyo, Japan, 1980
<b>College or University</b>	Tokyo Medical and Dental University undergraduate campus, Tokyo, Japan, 1980-1982.
<b>Medical School</b>	Tokyo Medical and Dental University School of Medicine, Tokyo, Japan, 1982-1986. Baccalaureate Medicinae and medical licensure, 1986.
<b>Postgraduate Research</b>	Dept. of Endocrinology, Medical Research Institute, Tokyo Medical and Dental University, Tokyo, Japan, 1986. Doctorate in Medical Science, 1993 (for ongoing research). Research topics: - "Changes in thymidine kinase isoenzyme and thymidylate synthase activities during carcinogenesis" - "Deletional analysis of the human renin promoter"



**Graduate School**

University of California San Francisco (UCSF),  
Interdepartmental Graduate Program in Endocrinology,  
1986-1994.

Doctorate in Philosophy, 1994.

Thesis topic:

- "Cell-specific targeting of  
retroviral vectors via  
ligand-receptor  
interaction"

(research performed in the laboratory of Dr. Y.W.  
Kan)

**Residency**

Residency Program in Laboratory Medicine/Clinical  
Pathology, University of California at San Francisco  
(UCSF), 1991-1993.

**Fellowship**

Postdoctoral fellowship, Howard Hughes Medical  
Institute (HHMI), University of California at San  
Francisco (UCSF), 1994-1995.  
(laboratory of Dr. Y.W. Kan)

**Honors & Awards**

University of California Regent's Fellowship Award, 1986

University of California Non-Resident Tuition Scholarship Award, 1987

Certificate of Distinction in Teaching for Excellent Small-Group Instruction, UCSF School of  
Medicine, 1988 & 1990

Howard Hughes Medical Institute Award in Recognition of Graduate Student Assistance in HHMI  
Laboratories, 1988, 1989, 1990, & 1991

Tokyo Medical and Dental University Alumni Association Young Investigators Research Award,  
1994

University of California San Francisco Chancellor Julius R. Krevans Distinguished Dissertation  
Award, 1995

Stop Cancer Foundation Career Development Award, 1996

Institut de Recherches Cliniques de Montreal (Clinical Research Institute of Montreal), Pfizer  
Travelling Fellowship, 1997

Cooley's Anemia Foundation Research Fellowship Award, 1998 & 1999

USC Research Center for Liver Diseases New Investigator Award, 1998

UCLA Department of Medicine Research Day Awards, 2005

1<sup>st</sup> place, Wet Lab Trainee category (to Dr. Shuji Kubo in my lab)

3<sup>rd</sup> place, Wet Lab Trainee category (to Dr. Kei Hiraoka in my lab)

Clinical Impact Award, Global Life Science Innovation Competition @UCSF, QB3, UCSF, 2006

Overall 2<sup>nd</sup> Place Award, Global Life Science Innovation Competition @UCSF, QB3, UCSF, 2006

CURE Digestive Disease Research Center Annual Symposium, UCLA

Outstanding Poster Award, Basic Research Category, 2007



#### LICENSURE & BOARD CERTIFICATIONS

Medical licensure, Ministry of Health and Welfare of Japan, 1986, License No. 300836

United States Educational Commission for Foreign Medical Graduates

(ECFMG):            –Certification, 1986  
                              –Permanent Validation, 1992

Medical licensure, State of California, 1994,  
License No. A053074

American Board of Pathology (Clinical Pathology), diplomate, 1996

#### PROFESSIONAL BACKGROUND

Teaching Assistant in Physiology/Endocrinology, University of California San Francisco, 1988-1989.

Course Instructor (voluntary), Physiology/Endocrinology, University of California San Francisco, 1990.

Resident Physician in Laboratory Medicine/Clinical Pathology, University of California San Francisco, 1991-1993.

Postgraduate Researcher, Howard Hughes Medical Institute, University of California San Francisco, 1994-1995.

Assistant Professor, Department of Pathology and Department of Biochemistry & Molecular Biology, and Institute for Genetic Medicine, University of Southern California (USC), 1996-2002.

Visiting Associate Professor, Department of Medicine / Division of Digestive Diseases, University of California Los Angeles (UCLA), 2002-2003.

Visiting Associate Professor (non-compensated voluntary title for on-going supervision of current graduate students still officially enrolled at USC), Department of Biochemistry & Molecular Biology, University of Southern California, 2003-present.

Associate Professor (regular series appointment, Step I), Department of Medicine, University of California Los Angeles (UCLA), 2003-present.

Associate Professor (regular series appointment, Step II), Department of Medicine, University of California Los Angeles (UCLA), 2004-present.

Associate Professor (secondary appointment, Step II), Dept. of Molecular & Medical Pharmacology, University of California Los Angeles (UCLA), 2006-present.

Associate Professor (regular series appointment, Step III), Department of Medicine, University of California Los Angeles (UCLA), 2007-present.

Assistant Director, HLA Immunogenetics Lab, National Institute of Transplantation, St. Vincent's Medical Center, Los Angeles, 2008-present.

#### OTHER EMPLOYMENT ACTIVITIES

Member, USC/Norris Comprehensive Cancer Center, University of Southern California, 1996-2002.



Member, IGM/Norris Joint Gene Therapy Program, University of Southern California, 1996-2002.

Member, USC/Norris Breast Cancer Research Program, University of Southern California, 1997-2002.

Member, USC Research Center for Liver Diseases, University of Southern California, 1997-2002.

Member, CURE Digestive Diseases Research Center, University of California Los Angeles, 2003-present.

Member, Jonsson Comprehensive Cancer Center, University of California Los Angeles, 2003-present.

Member, Interdepartmental Program in Molecular Biology, Molecular Biology Institute, University of California Los Angeles, 2003-present.

#### TEACHING RESPONSIBILITIES

Biochemistry and physiology tutor for 1st and 2nd year medical students, UCSF, 1988-1990 (Benjamin Brown, Nancy Burnside, Susan Garay, Lucy Lin)

Office hours and review lectures on cardiovascular, respiratory, & renal physiology (Physiology 100) for 1st year medical students, UCSF, 1988-1989

Office hours and review lectures on gastrointestinal and endocrine physiology (Physiology 101) for 1st year medical students, UCSF, 1988-1989

Discussion section and lab instructor in cardiovascular, respiratory and renal physiology course (Physiology 100) for 1st year medical students, UCSF, 1990

Cancer Center Grand Rounds (for residents/fellows/technologists), USC, 1996  
"Targeting Viral Vectors to Cancer Cells" (lecture)

Liver Disease Research Center Seminar (for residents/fellows/graduate students), USC, 1997  
"Targeting Gene Delivery via Ligand-Receptor Interaction" (lecture)

Pathology Grand Rounds (for pathology residents/fellows/technologists), USC, 1997  
"Gene Therapy Techniques" (lecture)

Pulmonary Division Research Seminar (for pulmonary medicine fellows), USC, 1997  
"Gene Delivery to the Lung" (lecture)

Seminars in Pathology (PATH 570) course instructor, USC, 1997 & 2000  
(Dept. of Pathology/course director: Dr. Cheng-Ming Chuong)  
"Topics in Gene Therapy" (lectures & discussion)

Human Molecular Genetics (BIOC 599) course instructor, USC, 1998 & 1999  
(Dept. of Biochemistry/course directors: Dr. Jane Fountain & Dr. Sita Reddy)  
"Gene Therapy: Vectors" (lecture & final exam)

Recent Advances in Molecular Biology (BIOC 599) course co-director, USC, 1998  
(Dept. of Biochemistry/course directors: Dr. Zoltan Tokes & Dr. Noriyuki Kasahara)



- Methods in Experimental Pathology (PATH 552B) course co-director, USC, 1998 & 1999  
(Dept. of Pathology/course directors: Dr. Louis Dubeau & Dr. Noriyuki Kasahara)
- Human Molecular Genetics (BIOC 543) course instructor, USC, 2000 & 2001  
(Dept. of Biochemistry/course director: Dr. Juergen Reichardt & Dr. Joseph Hacia)  
"Genetic therapy and other molecular genetic-based therapeutic approaches" (lecture & final exam)
- General Pathology core curriculum in histopathology (PATH 550) course instructor, USC, 2001 & 2002  
(Dept. of Pathology/course director: Dr. Arnis Richters)  
"Histopathology of the endocrine system" (lecture & labs)
- General Pathology core curriculum in microbiology (PATH 550) course instructor, USC, 2002  
(Dept. of Pathology/course director: Dr. Louis Dubeau & Dr. Julie Badger)  
"Virology: classification and structure" (lecture)
- Methods in Experimental Pathology (PATH 552B) course director, USC, 2000-2002  
(Dept. of Pathology/course director: Dr. Noriyuki Kasahara)
- Gastroenterology Journal Club preceptor, UCLA; August 22, 2003  
"Virus vs. Cancer: Replication-Competent Adenovirus and Metastatic GI Malignancies" (presented by GI Fellow, Dr. Richard Hu)
- Medical Grand Rounds, UCLA, October 8, 2003  
"Oncolytic viruses and Trojan horses: new tools for gene therapy" (lecture)
- Molecular and Pathobiological Basis of Gene Therapy Applications (M 298) course co-director, UCLA, Fall quarter 2003 (Interdepartmental Program in Molecular Biology / course directors: Dr. Lily Wu & Dr. Noriyuki Kasahara)
- UCLA Undergraduate Research Consortium in Functional Genomics (URCFG)  
(Howard Hughes Medical Institute-sponsored course for undergraduates), UCLA; May 24, 2004  
Life Sciences Core Curriculum LS10H/course director: Dr. Utpal Banerjee  
"From Bugs to Drugs: Development of Genetic Medicines for the 21st Century" (guest lecture)
- Gastroenterology Journal Club preceptor, UCLA; September 3, 2004  
"Mechanism of Pancreas Regeneration: Growing  $\beta$ -cells in a Hostile Environment" (presented by GI Fellow, Dr. Michael Mendoza)
- Division of Laboratory Animal Medicine seminar (for DLAM fellows), UCLA; February 18, 2005  
"Concepts and Methods in Gene Therapy" (lecture)
- Division of Digestive Diseases educational seminar (for GI fellows), UCLA; March 24, 2006  
"Gene Transfer Technologies for Research and Therapeutic Applications" (lecture)
- Department of Surgery basic science seminar (for surgical fellows), UCLA; May 24, 2006  
"Gene Transfer Technologies for Research and Therapeutic Applications" (lecture)
- Gastroenterology Journal Club preceptor, UCLA; August 4, 2006  
"Stem Cells and Pancreas Regeneration" (presented by GI Fellow, Dr. David Shih)
- Medical Grand Rounds, UCLA, April 11, 2007  
"Clinical application of gene therapy, virotherapy, and regenerative medicine" (lecture)



Current Challenges in Cellular Engineering and Genetic Therapies (M 298) course co-director, UCLA, Spring quarter 2007 (Interdepartmental Program in Molecular Biology / course directors: Dr. Lily Wu & Dr. Noriyuki Kasahara)

Gene and Cell-Based Therapy (Ph 288) course instructor, UCLA, Spring quarter 2008 (Molecular & Medical Pharmacology course director: Dr. Samson Chow)  
"Retrovirus-based vectors and RCR" (lecture & discussion)

### SUPERVISION OF GRADUATE & POST-GRADUATE RESEARCH

#### **Current undergraduate & graduate students and postdoctoral fellows in my lab**

- Christopher R. Logg (Ph.D. in Pathology, USC, 2002)  
**Post-doctoral fellow, USC, 4/02-4/03; UCLA, 4/03 - present**  
Research project: Development of targeted replication-competent retrovirus (RCR) vectors
- Emmanuelle Faure (Ph.D. in Biochemistry & Molecular Biology, University of Paris IX, 1996)  
**Post-doctoral fellow, USC, 8/02-4/03; UCLA, 4/03-6/06**  
**Staff Research Associate III, UCLA, 7/06 - present**  
Research project: Development of novel adenovirus-lentivirus hybrid vectors
- Kei Hiraoka (M.D., Hokkaido University, Japan, 1995;  
Ph.D., Surgical Oncology, Hokkaido University, Japan, 2002)  
**Post-doctoral fellow, UCLA, 4/03-present**  
Research project: Anti-angiogenic and immuno-oncolytic gene therapy for GI cancers
- Kazunori Haga (M.D., Hokkaido University, Japan, 1994;  
Ph.D. in Oncology, Hokkaido University, Japan, 2002)  
**Post-doctoral fellow, UCLA, 4/05-present**  
Research project: Combining virotherapy and immunotherapy for cancer
- Nathan Lemp (B.Sc. in Chemistry, U.C. Berkeley, 2000)  
**Ph.D. candidate (Molecular & Medical Pharmacology, UCLA), 7/06-present**  
Research project: Histocompatibility modulation by siRNA-mediated knockdown of HLA
- Izumi Ohno (M.D., Chiba University, Japan, 1995;  
Ph.D., Gastroenterology, Chiba University, Japan, 2007)  
**Post-doctoral fellow, UCLA, 8/07 - present**  
Research project: Anti-angiogenic and immuno-oncolytic gene therapy for GI cancers
- Kip Hermann (BSc., University of California Los Angeles, 2005)  
**Lab Assistant, UCLA -VAMC, 2005 – 10/07**  
**Staff Research Associate I, UCLA, 10/07 - present**



Research project: Development of retroviral and lentiviral vectors for cancer therapy

Emily Liao

**Undergraduate student (Biochemistry, UCLA), 9/07-present**

Research project: Lineage-specific post-transcriptional regulation of retroviruses

Xiangdong Deng (Ph.D., Molecular Human Genetics, Kyushu University, Japan, 2008)

**Post-doctoral fellow, UCLA, 4/08 - present**

Research project: Retroviral gene therapy of primary human brain tumor stem cells

Katrin Hacke (Ph.D., Oncology, Ruprecht-Karls-University, Heidelberg, Germany, 2007)

**Post-doctoral fellow, UCLA, 4/08 - present**

Research project: Genetic modification of leukemia cells and stem cell-derived allografts

Gretchen Lam

**Undergraduate student (Engineering, UCLA), 7/08-present**

Research project: Improving efficacy of retrovirus vectors for gene therapy of cancer

**Previous students and post-doctoral fellows trained in my lab**

Baranick, Brian (M.S. student, Pathology, USC; 2001-2003, graduated Summer 2003)

Ph.D. student, Molecular Biology, UCLA; 2003-2007, graduated Fall 2007)

Master's thesis project: Development of lentivirus vectors for anti-inflammatory gene therapy

Ph.D. thesis project: Characterization and utilization of replication-competent retroviral vectors

*Current position: Biotechnology analyst, L.E.K. Consulting, Los Angeles*

Chang, Tommy Yao-Sung (M.S. student, Biochemistry, USC; 1996-1999, graduated Spring 1999)

Master's thesis project: Ligand-mediated targeting of retroviral vectors

*Current position: Associate Researcher, Genomics Dept., Industrial Technology Research Institute, Taiwan*

Chodon, Thinle (M.D., Tribhuvan University Institute of Medicine, Kathmandu, Nepal, 1995; Ph.D., Plastic & Reconstructive Surgery, Hokkaido University, Japan, 2001)

**Post-doctoral fellow, UCLA, 3/06 - present**

**Staff Research Associate II, UCLA, 10/07 - present**

*Current position: Assistant Research Scientist, Dept of Medicine, UCLA*



Harboe-Schmidt, Jens-Erik (visiting M.S. student, Royal Danish School of Pharmacy, Denmark, 1999 Ph.D. student, Biochemistry, USC; 1999-2006, graduated Fall 2006)

Ph.D. thesis project: Lentivirus-mediated gene transfer to mucosal epithelium

*Current position: St. George's University School of Medicine, Granada*

Higo, Collin (M.S. student, Biochemistry, USC; 1997-1999, graduated Summer 1999)

Master's thesis project: Development of adenovirus-retrovirus hybrid vectors

*Current position: Biotechnology investor*

Hung, Tan-Ki (Sophie) (Undergraduate student (Molecular, Cell, & Developmental Biology, UCLA), 7/06-6/07, graduated Spring 2007)

Undergraduate research project: Combination chemotherapy and suicide gene therapy for cancer

*Current position: applying to Masters program in Public Health*

Jih, Lily Ja-Lu (high school student volunteer, USC; 1996-1997 summer rotation, USC (as UC Berkeley undergraduate); 1998, 1999)

Research project: Development of adenovirus-retrovirus hybrid vectors

*Current position: obtained M.D. degree at University of California San Diego (UCSD), 2006; currently resident physician, Department of Pathology, UCSD, 2006-present*

Kaissi, Samira (Ph.D. student, Biochemistry, USC; 1996-2002, graduated Fall 2002)

Ph.D. thesis project: Analysis of Klotho, a gene involved in age-related disease pathogenesis

*Current position: Systems Biology Technical Manager for North American Operations, Beckman Coulter Inc., Fullerton, CA*

Kimura, Takahiro (Post-doctoral fellow, UCLA, 7/03-9/06)

Research project: Development of retroviral and lentiviral vectors for cancer therapy

*Current position: Assistant Professor, Department of Urology, Jikei University School of Medicine, Japan*

Kubo, Shuji (Post-doctoral fellow, UCLA, 4/03-4/06)

Research project: Development of novel adenovirus-retroelement hybrid vectors

*Current position: Assistant Professor, Institute for Advanced Medical Sciences, Hyogo College of Medicine, Japan*

Lin, Amy H. (Post-doctoral fellow, UCLA, 1/06-12/06)



Research project: Development of lentiviral vectors for cancer immunotherapy  
*Current position: Post-doctoral fellow (Carol Kruse lab), Sidney Kimmel Cancer Center.*

Logg, Christopher R. (Ph.D. student, Pathology, USC; 1996-2002, graduated Spring 2002)

Ph.D. thesis project: Development of replication-competent retrovirus vectors  
*Current position: Post-doctoral Fellow (Kasahara lab), UCLA*

Mazurek, Constance (Post-doctoral Research Associate, Vector Core, USC, 7/00-6/02)

Research project: Development of adenoviral and lentiviral vectors for research applications  
*Current position: Research Associate (John Zaia lab), City of Hope Medical Center*

Nagashima, Jill (Ph.D. student, Molecular Biology, UCLA, 7/04-6/05)

Research project: Lentivirus-mediated gene transfer of siRNA for cellular transplantation

*Current position: transferred to Harvard University Graduate Program in Virology as of 7-05*

Sazawa, Ataru (Post-doctoral fellow, USC & UCLA; 4/01-5/03)

Research project: Development of lentivirus vectors for immunological gene therapy  
*Current position: Assistant Professor, Dept. of Urology, Hokkaido University, Japan*

Shichinohe, Toshiaki (Post-doctoral fellow, USC; 4/99-4/02)

Research project: Development of lentivirus vectors for anti-angiogenic gene therapy  
*Current position: Assistant Professor, Dept of Surgery, Hokkaido University, Japan  
Visiting Assistant Professor of Pathology, USC*

Soifer, Harris (Ph.D. student, Biochemistry, USC; 1997-2002, graduated Summer 2002)

Ph.D. thesis project: Development of adenovirus-retrotransposon hybrid vectors  
*Current position: Beckman Fellow (John Rossi lab), City of Hope Medical Center*

Tai, Chien-Kuo (M.S. student, Pathology, USC; 1997-1999, graduated Summer 1999  
Ph.D. student, Pathology, USC; 1999-2002, graduated Fall 2002)

Post-doctoral fellow, USC, 9/02-4/03; UCLA, 4/03-7/05)

Master's thesis project: Antibody-mediated targeting of retroviral vectors

Ph.D. thesis project: Replication-competent retroviral vectors for suicide gene therapy of cancer

Post-doctoral research project: Application of RCR vectors to suicide gene therapy of glioma

*Current position: Assistant Professor, Dept of Life Sciences, National Chung Cheng University, Taiwan*



Yaoi, Aki (now Logg, Aki) (M.S. student, Biochemistry, USC; 1998-2000, graduated Spring 2000)

Master's thesis project: Transcriptional targeting of retroviral vectors

*Current position: obtained M.S. degree in Genetic Counseling at UC Irvine, 2003; now genetic counselor with Alpha Therapeutics*

Yoon, Laurent Tack-Kee (Ph.D. student, Biochemistry, USC, 1999-2005, graduated Summer 2005)

Ph.D. thesis project: Genomic stability of transcriptionally targeted RCR vectors

*Current position: Biotechnology Consultant, McKinsey & Company*

**Rotation students previously trained in my lab**

Christopher R. Logg (Ph.D. student, Pathology, USC; lab rotation 6/96-8/96)

Cindy Eads (Ph.D. student, Biochemistry, USC; lab rotation 9/96-11/96)

Connie Chan (Ph.D. student, Biochemistry, USC; lab rotation 3/97-5/97)

Stephen Koh (Ph.D. student, Pathology, USC; lab rotation 12/97-2/98)

Michael-Zhigang Song (Ph.D. student, Pathology, USC; lab rotation 3/98-5/98)

Harris Soifer (Ph.D. student, Biochemistry, USC; lab rotation 3/98-5/98)

Emma Taylor (undergraduate student, Molecular & Cellular Biology, UC Berkeley; recipient of USC Edmondson Program Summer Fellowship, 1996 & 1999)

Ja-Lu (Lily) Jih (Alhambra high school student volunteer, 1996-1997; Westinghouse Science Talent Competition semi-finalist, 1997; undergraduate student, Molecular & Cellular Biology, UC Berkeley; recipient of USC Edmondson Program Summer Fellowship, 1998 & 1999)

Erik Harboe-Schmidt (Visiting exchange student, Royal Danish School of Pharmacy; research work contributing to Master's thesis in Pharmacy, 9/98-6/99)

Remi Tsukamoto (undergraduate student, Harvard-Westlake High School; recipient of USC Edmondson Program Summer Fellowship, 2000)



Erin Weber	(M. D./Ph.D. student, USC School of Medicine; lab rotation 6/01–8/01)
Unnati Jariwala	(Ph.D. student, Pathology, USC; lab rotation 3/02–5/02)
Sarah Nightingale	(Ph.D. student, Microbiology, USC; lab rotation 3/02–5/02)
Rachel Lee	(undergraduate student, Molecular Biology, Harvard University; recipient of USC Edmondson Program Summer Fellowship, 2002)
Christine Shahgaldian	(undergraduate student, UCLA; supervised research studies (M 199) 9/03–6/04)
Petros Anagnostidis	(undergraduate student, UCLA; supervised research studies (M 199) 9/04–6/05, 9/05–6/06)
Jill Nagashima	(ACCESS graduate student, UCLA; lab rotation 4/04–6/04)
Quincy Tam	(undergraduate student, UC Santa Cruz; lab rotation through the UC LEADS summer research program 7/05–8/05)
Nathan Lemp	(ACCESS graduate student, UCLA; lab rotation 7/05–9/05)
Tan-Ki (Sophie) Hung	(undergraduate student, UCLA; supervised research studies (M 199) 4/06–6/07)
Leili Farzaneh	(visiting undergraduate student, Imperial College of Science and Technology, London, UK; summer research studies 7/06–9/06)

**Visiting scholars previously in my lab**

David Woodley, M.D.	(mini-sabbatical 1/99–6/99 as Chair of Dermatology, Northwestern University; <i>current position: Chair of Dermatology, USC</i> )
Renata Stripecke, Ph.D.	(visiting researcher 6/99–9/99 as post-doctoral fellow from Childrens Hospital Los Angeles, continuing as Assistant Professor of Research, Dept. of Pathology, USC; <i>current position: Adjunct Assistant Professor of Medicine, UCLA</i> )
Maria Barcova, Ph.D.	(visiting researcher 4/00–4/01 as Senior Scientist from IntraGene Sciences Inc., subsequently Senior Scientist at Geron Inc.; <i>current position: Associate Research</i> )



*Scientist, Burnham Institute of Allergy and Immunology, San Diego)*

Celina Ngiam, Ph.D. MBA (visiting researcher 4/00-4/01 as Senior Scientist from IntraGene Sciences Inc.; *current position: Chief Operating Officer, IC Biotechnologies, Inc.*)

Emmanuelle Faure, Ph.D. (visiting researcher 4/01-7/02 as Senior Scientist from IntraGene Sciences Inc.; *current position: Vector Core Supervisor, Kasahara lab, UCLA*)

**Participation in Qualifying Exam Committees for USC graduate students, 1997-2002:**

**Member of Qualifying Exam Committees for the following students in 1997:**

Janet Chen	(Ph.D. student, Pathology)
Han Ma	(Ph.D. student, Pathology)
Hector Aguilar	(Ph.D. student, Biochemistry)
Sunyoung Lee	(Ph.D. student, Biochemistry)
Vincent Lee	(Ph.D. student, Biochemistry)
Amy Lin	(Ph.D. student, Biochemistry)
Eleanora Goldberg	(Ph.D. student, Biochemistry)

**Member of Qualifying Exam Committees for the following students in 1998:**

Christopher Logg	(Ph.D. student, Pathology)
Richard McHugh	(Ph.D. student, Pathology)
Mariana Keshmeshian	(Ph.D. student, Pathology)
Samira Kaissi	(Ph.D. student, Biochemistry)
Timothy Hung-Po Chen	(Ph.D. student, Biochemistry)
Cindy Eads	(Ph.D. student, Biochemistry)
Martha Pao	(Ph.D. student, Biochemistry)
Phini Strati	(Ph.D. student, Biochemistry)
Edward Yu	(Ph.D. student, Biochemistry)

**Member of Qualifying Exam Committees for the following students in 1999:**

Zhigang Song	(Ph.D. student, Pathology)
Stephen Koh	(Ph.D. student, Pathology)
Harris Soifer	(Ph.D. student, Biochemistry)
Jiapeng Huang	(Ph.D. student, Biochemistry)
Xinhua Chen	(Ph.D. student, Biological Sciences)
Brian Roehmholdt	(M.D. Ph.D. student, Cell & Neurobiology)
Dennis Haas	(Ph.D. student, Microbiology & Immunology)
Tanja Gruber	(M.D. Ph.D. student, Microbiology & Immunology)

**Member of Qualifying Exam Committees for the following students in 2000:**

Chien-Kuo Tai	(Ph.D. student, Pathology)
Jian Wu	(Ph.D. student, Pathology)
Hongwei Li	(Ph.D. student, Pathology)
Saswati Hazra	(Ph.D. student, Pathology)
Candy Chan	(Ph.D. student, Pathology)
Ilias Christodouloupoulos	(Ph.D. student, Biochemistry)



Brett Ball	(M.D. Ph.D. student, Biochemistry)
Jun Zuo	(Ph.D. student, Microbiology & Immunology)
Suzanne Peterson	(Ph.D. student, Microbiology & Immunology)

**Member of Qualifying Exam Committees for the following students in 2001:**

Jennifer Zhong	(Ph.D. student, Pathology)
Jiali Li	(Ph.D. student, Pathology)
Bongha Shin	(Ph.D. student, Pathology)
Erik Harboe-Schmidt	(Ph.D. student, Biochemistry)
Paolo Abada	(M.D. Ph.D. student, Biochemistry)

**Member of Qualifying Exam Committees for the following students in 2002:**

Ani Khodavirdi	(Ph.D. student, Pathology)
Laurent Yoon	(Ph.D. student, Biochemistry)

**Participation in Thesis Guidance Committees for USC graduate students, 1997-2004:**

**Member of Thesis Guidance Committees for the following Ph.D. students:**

Stephen Koh	(Ph.D., Pathology; graduated Summer 2001)
Christopher Logg*	(Ph.D., Pathology; graduated Spring 2002)
Michael-Zhigang Song	(Ph.D., Pathology; graduated Spring 2002)
Chien-Kuo Tai*	(Ph.D., Pathology; graduated Fall 2002)
Saswati Hazra	(Ph.D., Pathology; graduated Summer 2003)
Amy Lin	(Ph.D., Biochemistry; graduated Summer 2000)
Hector Aguilar	(Ph.D., Biochemistry; graduated Summer 2002)
Jiapeng Huang	(Ph.D., Biochemistry; graduated Summer 2002)
Harris Soifer*	(Ph.D., Biochemistry; graduated Summer 2002)
Timothy Hung-Po Chen	(Ph.D., Biochemistry; graduated Fall 2002)
Martha Pao	(Ph.D., Biochemistry; graduated Fall 2002)
Samira Kaissi*	(Ph.D., Biochemistry; graduated Fall 2002)
Brian Roehmholdt	(Ph.D., Cell & Neurobiology; graduated Summer 2001)
Tanja Gruber	(Ph.D., Microbiology & Immunology; graduated Summer 2002)
Richard McHugh	(Ph.D., Pathology; graduated Summer 2003)
Jiali Li	(Ph.D., Pathology; graduated Summer 2004)
Jennifer Zhong	(Ph.D., Pathology; graduated Spring 2004)
Ilias Christodoulopoulos	(Ph.D., Biochemistry; graduated Spring 2004)
Erik Harboe-Schmidt*	(Ph.D., Biochemistry; graduated Summer 2006)
Laurent Yoon*	(Ph.D., Biochemistry; graduated Summer 2005)
Paolo Abada	(M.D. Ph.D., Biochemistry; graduated Fall 2004)
Dennis Haas	(Ph.D., Microbiology & Immunology; graduated Summer 2004)
Suzanne Peterson	(Ph.D., Microbiology & Immunology; graduated Summer 2004)

**Member of Thesis Guidance Committees for the following M.S. students:**

Chien-Kuo Tai*	(M.S., Pathology; graduated Summer 1999)
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Vincent Lee	(M.S., Biochemistry; graduated Spring 1998)
Tommy Yao-Sung Chang*	(M.S., Biochemistry; graduated Spring 1999)
Collin Higo*	(M.S., Biochemistry; graduated Summer 1999)
Aki Yaoi Logg*	(M.S., Biochemistry; graduated Spring 2000)
Elizabeth Felix-Trunelle	(M.S., Biochemistry; graduated Spring 2001)
Patricia Sharpe	(M.S., Biochemistry; graduated Spring 2002)
Edward Yu	(M.S., Biochemistry; graduated Summer 2002)
Brian Baranick*	(M.S., Pathology; graduated Spring 2003)

(\* denotes students from my own lab)

**Participation in Qualifying Exam Committees for UCLA graduate students, 2003–present**

**Member of Qualifying Exam Committees for the following students in 2003:**

Andrew Melton	(Ph.D. candidate; Molecular, Cellular & Integrative Physiology, UCLA)
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**Member of Qualifying Exam Committees for the following students in 2004:**

Joyce Sayegh	(Ph.D. candidate; Molecular Biology, UCLA)
Breanne White	(Ph.D. candidate; Molecular Biology, UCLA)

**Member of Qualifying Exam Committees for the following students in 2006:**

Brian Baranick*	(Ph.D. candidate; Molecular Biology, UCLA)
Shuwen Koh	(Ph.D. candidate; Biomedical Engineering, UCLA)

**Member of Qualifying Exam Committees for the following students in 2007:**

Cecilia Yuen-Ting Chan	(Ph.D. candidate; Molecular Toxicology, UCLA)
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**Participation in Thesis Guidance Committees for UCLA graduate students, 2003-present**

**Member of Thesis Guidance Committees for the following Ph.D. students:**

Andrew Melton	(Ph.D., Molecular, Cellular & Integrative Physiology; graduated Spring 2006)
Breanne White	(Ph.D. candidate; Molecular Biology, UCLA; graduated Spring 2008)
Brian Baranick*	(Ph.D.; Molecular Biology, UCLA; graduated Fall 2007)
Shuwen Koh	(Ph.D. candidate; Biomedical Engineering, UCLA)

(\* denotes students from my own lab)

**ADMINISTRATIVE RESPONSIBILITIES**

Director, Research Vector Core, Institute for Genetic Medicine, University of Southern California, 1996-2002.

Co-Director, Molecular Biology Core/Vector Subcore, USC Research Center for Liver Diseases, University of Southern California, 1999-2002.

Director, Viral Vector Development Core, USC/Norris Comprehensive Cancer Center, University of Southern California, 2002.

Director, Molecular Biology/ Gene Transfer Vector Core, CURE Digestive Diseases Research Center, University of California Los Angeles, 2003-present.



Director, UCLA Hepatitis Screening Program, Division of Digestive Diseases, Dept. of Medicine, University of California Los Angeles, 2004-present.

Director, Vector Core/ Shared Resource, Jonsson Comprehensive Cancer Center, University of California Los Angeles, 2005-present.

## COMMITTEE MEMBERSHIPS

### Departmental/Divisional Committees

Member, Annual Departmental Retreat Planning Committee, Dept. of Biochemistry, University of Southern California School of Medicine, 1999.

Member, Graduate Admissions and Education Committee, Dept. of Pathology, University of Southern California School of Medicine, 2000-2002.

Member, Executive Committee, CURE Digestive Diseases Research Center, University of California Los Angeles, 2003 – present.

Member, Academic Career Development Committee (ACDC), Division of Digestive Diseases, Department of Medicine, University of California Los Angeles, 2004 – present.

Member, Executive Research Council, Division of Digestive Diseases, Department of Medicine, University of California Los Angeles, 2004 – present.

Co-Chair, Strategic Planning Committee, Division of Digestive Diseases, Department of Medicine, University of California Los Angeles, 2005 – present.

### School of Medicine Committees

Member, Institutional Biosafety Committee (IBC), University of Southern California School of Medicine, 1998-2002.

Member, Executive Committee, Research Center for Liver Diseases, University of Southern California School of Medicine, 1999-2002.

Co-Chair (with Dr. H. Kornblum), Jonsson Comprehensive Cancer Center Seminar Series Committee, University of California Los Angeles, 2005-2006.

### University Committees

Member, Interdepartmental Graduate Program (PIBBS) Admissions Committee, University of Southern California, 1996-2002.

Member, Interdepartmental Basic Science Seminar Series Committee, University of Southern California, 1997-2002.

Chair, Interdepartmental Basic Science Seminar Series Committee, University of Southern California, 1998-2002.

Member, Institutional Biosafety Committee (IBC; re-formed as university-wide committee in 2000), University of Southern California, 2000-2002.

Member, Institutional Biosafety Committee (IBC), University of California Los Angeles, 2004-present.

## MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS



Japan Society for Cancer Chemotherapy

American Association for the Advancement of Science

American Society for Microbiology

American Society of Biochemistry & Molecular Biology

American Association for Cancer Research

American Society of Gene Therapy (ASGT)

(Member, ASGT Scientific Committee on Viral Gene Transfer Vectors, 2003-2006 and 2006-2009; Member, ASGT International Committee, 2005-2008)

Japan Society of Gene Therapy

Member, JSGT International Exchange Committee, 2007 - present)

International Society of Cancer Gene Therapy (ISCGT)

(re-named International Society for Cell and Gene Therapy of Cancer in 2004)

(Member, ISCGT Executive Council, 2003-present; President-Elect, ISCGT, 2007-present)

British Society for Gene Therapy

## CONSULTANSHIPS AND OTHER PROFESSIONAL ACTIVITIES

### Local

Member, Childrens Hospital Los Angeles (CHLA) Postdoctoral Research Fellowship study section, 1997-2000.

Member, Pre-review committee for Margaret Early Research Trust grant application submissions, 1999.

Member, External Data Safety Monitoring Board, USC clinical trial "Collagen-Targeted Retroviral Vectors for Gene Therapy of Hepatic Colorectal Metastasis" (Principal Investigator: Dr. Heinz-Josef Lenz, USC), 2001-2003.

Member, Internal Advisory Board, CHLA Program Project, "Gene Therapy Using Hematopoietic Stem Cells" (Program Director: Dr. Donald B. Kohn, CHLA/USC), 2002-2003.

### National / International

Member, Ad-hoc study section, NIH (National Institute for Neurological Disorders & Stroke), 1996 & 1997.

Ad-hoc manuscript reviewer, *Human Gene Therapy*, 1996-present.

Ad-hoc manuscript reviewer, *Journal of Virology*, 1997-present.

Ad-hoc manuscript reviewer, *Pharmaceutical Research*, 1999-present.

Ad-hoc manuscript reviewer, *Leukemia*, 2000-present.

Ad-hoc manuscript reviewer, *Nature Biotechnology*, 2001-present.

Ad-hoc manuscript reviewer, *Virology*, 2001-present.



Ad-hoc manuscript reviewer, *Molecular Therapy*, 2003–present.

Ad-hoc manuscript reviewer, *Journal of Gene Medicine*, 2004–present.

Ad-hoc manuscript reviewer, *Science*, 2005–present.

Ad-hoc manuscript reviewer, *Clinical Cancer Research*, 2006–present.

Ad-hoc manuscript reviewer, *Cancer Research*, 2007–present.

**Member, Editorial Board, *Cancer Gene Therapy*, 2001–present.**

**Member, Editorial Board, *Current Molecular Pharmacology*, 2007–present.**

Session Chair, Cancer Gene Therapy session, 7<sup>th</sup> annual meeting of the Japan Society of Gene Therapy, 2001.

Session Chair, Gene Therapy in Asia session, 8<sup>th</sup> annual meeting of the Japan Society of Gene Therapy, 2002.

Chair, Symposium on Molecular and Genetic Diagnosis and Treatment of Hepato-Pancreato-Biliary Disease, 5th World Congress of the International Hepato-Pancreato-Biliary Association, 2002.

Abstract Review Committee member and Session Moderator, Cancer Suicide Gene Therapy session, 5<sup>th</sup> annual meeting of the American Society of Gene Therapy, 2002.

Member, Organizing Committee, 2<sup>nd</sup> International Meeting on Replicating Oncolytic Viruses for Cancer Therapy, 2002-2003.

Abstract Review Committee member and Session Moderator, Cancer Targeted Gene Therapy session, 6<sup>th</sup> annual meeting of the American Society of Gene Therapy, 2003.

Faculty Instructor, Workshop (WS 210): Replicating Vectors for Cancer Therapy, 6<sup>th</sup> annual meeting of the American Society of Gene Therapy, 2003.

Site visit committee member, Quinquennial Review of the Melanoma Gene Therapy Group at University College London, on behalf of Cancer Research UK, 2003

Member, Scientific Committee on Viral Gene Transfer Vectors, American Society of Gene Therapy, 2003-2006.

**Member, Executive Council, International Society of Cancer Gene Therapy (now International Society for Cell and Gene Therapy of Cancer), 2003-present.**

Member, Organizing Committee, 3<sup>rd</sup> International Meeting on Replicating Oncolytic Viruses for Cancer Therapy, 2004-2005.

Abstract Review Committee member, RNA Vectors session, 7<sup>th</sup> annual meeting of the American Society of Gene Therapy, 2004.

Session Chair, Cellular Therapies symposium, 1<sup>st</sup> inaugural meeting of the British Society of Gene Therapy, 2004.

Member, Gene Therapy P01 Cluster Review study section (NCI-D RPRB (G9)), NIH, June 2004

Member, Immuno/Gene Therapy P01 Cluster Review study section (NCI-D RPRB (G9)), NIH, September 2004



- Ad Hoc Member, NCI Scientific Review Group Subcommittee D (Clinical and Translational Studies P01 Parent Committee), NIH, August & December 2004
- Ad Hoc Member, Developmental Therapeutics (DT) study section, Center for Scientific Review, NIH: June & October 2004
- Member, Gene Therapy P01 Cluster Review study section (NCI-D RPRB (G9)), NIH, May 2005
- Ad Hoc Member, Developmental Therapeutics (DT) study section, Center for Scientific Review, NIH: February, June & October 2005
- Ad Hoc Member, NCI Scientific Review Group Subcommittee D (Clinical and Translational Studies P01 Parent Committee), NIH, August 2005
- Faculty Instructor, Workshop (WS 217): Key Design Issues for Oncolytic Vectors, and Education Session (ES 105): Cancer Gene Therapy, 8<sup>th</sup> annual meeting of the American Society of Gene Therapy, June 2005.
- Panel Judge, Leslie Fairbairn Award, 3<sup>rd</sup> annual meeting of the British Society of Gene Therapy, 2006.
- Ad Hoc Member, SBIR study section (Special Emphasis Panel ZRG1 BDCN F12/A03), NIH -NEI, July 2005, February 2006
- Member, Organizing Committee, International Society for Cell and Gene Therapy of Cancer (ISCGT), 2006 Annual Meeting.
- Member, International Committee, American Society of Gene Therapy, 2005-2008.**
- Member, Scientific Committee on Viral Gene Transfer Vectors, American Society of Gene Therapy, 2006-2009 (newly re-elected).**
- Ad Hoc Member, Developmental Therapeutics (DT) study section, Center for Scientific Review, NIH: February & October 2006
- Member, Organizing Committee, 4<sup>th</sup> International Meeting on Replicating Oncolytic Viruses as Cancer Therapeutics, 2006-2007.
- Member, Organizing Committee, International Society of Cell and Gene Therapy for Cancer (ISCGT), 2007 Annual Meeting.
- Abstract Review Committee member and Session Moderator, Tumor Suppressor and Targeted Gene Therapy session, 10<sup>th</sup> annual meeting of the American Society of Gene Therapy, 2007.
- Member, Organizing Committee, 2007 Cold Spring Harbor Laboratory Symposium on In Vivo Barriers to Gene Delivery.
- Chair, Site Visit Committee for review of the Canadian Oncolytic Virus Consortium, on behalf of the National Cancer Institute of Canada (NCIC), February 2007**
- Regular Member, Developmental Therapeutics (DT) study section, Center for Scientific Review, NIH: Feb 2007-2009.**
- Member, Organizing Committee, 5<sup>th</sup> International Meeting on Replicating Oncolytic Viruses as Cancer Therapeutics, 2008-2009.
- Member, Organizing Committee, International Society of Cell and Gene Therapy for Cancer (ISCGT), 2008 Annual Meeting.
- Abstract Review Committee member and Session Moderator, RNA Virus Vectors session, 11<sup>th</sup> annual meeting of the American Society of Gene Therapy, 2008.



President-Elect, International Society for Cell & Gene Therapy of Cancer (ISCGT): April 2007-September 2008.

**President, International Society for Cell & Gene Therapy of Cancer (ISCGT):  
September 2008- 2010.**

## RESEARCH ACTIVITIES

### 1. Use of Therapeutic Genes Encoding Secreted Proteins in Standard Vector Systems

Using conventional adenoviral and lentiviral vector systems, we have developed strategies for delivery of secreted anti-angiogenic factors, including thrombospondin-1, angiostatin, and endostatin. We were the first to demonstrate that lentiviral vectors can achieve stable gene transfer of these anti-angiogenic factors, in order to exert long-term anti-proliferative effects on endothelial cell growth. We are now applying this strategy to diseases in which neovascularization plays a major role, such as cancer and rheumatoid arthritis.

In a related project, we have also been exploring strategies for inhibition of inflammation and fibrosis, by gene delivery of, e.g., interleukin-1 receptor antagonist (IL-1ra) and a dominant-negative soluble form of transforming growth factor beta (TGF- $\beta$ ) receptor. We are now seeking to further explore this approach in other models of chronic inflammatory disease, including pulmonary fibrosis and inflammatory bowel disease.

We were also the first to demonstrate that lentivirus vectors can achieve efficient transduction of quiescent alveolar epithelial cells via entry from the apical (i.e., air/liquid interface) side. This represents a minimally invasive approach that can not only achieve gene delivery to the local tissue, but can also access the large surface area of the pulmonary vasculature for efficient secretion of therapeutic proteins into the circulation.

Another approach using conventional vectors to genetically modify cells with secreted factors, currently being pursued by Dr. Renata Stripecke, an Adjunct Assistant Professor in my group, is to develop lentiviral vectors for expression of immunostimulatory cytokines to activate anti-cancer immune responses. Using this approach, we have shown that lentivirus-mediated production of immunoactivators such as GM-CSF directly from leukemia cells can convert them into tumor vaccines, and that gene transfer of lentiviral vectors encoding GM-CSF, IL-4, and tumor antigens can convert peripheral blood monocytes directly into tumor antigen-presenting dendritic cells for stimulation of potent anti-tumor immune responses after adoptive transfer *in vivo*. Dr. Stripecke has been in my group for the past 7 years since her post-doctoral fellowship, and I have fully encouraged her career development and have supported her research through my funding. She has just recently moved to a fully independent faculty position in Germany, and we will continue to collaborate together, as well as with other collaborators at UCLA (Dr. Gary Schiller, Dr. Ronald Paquette, and Dr. Antoni Ribas), UCSF (Dr. Karin Gaensler), University of Washington Seattle (Dr. Hans-Peter Kiem), the National Gene Vector Lab (Dr. Kenneth Cornetta), and Kings College London (Dr. Farzin Farzaneh) towards developing a clinical trial for genetically-modified leukemia vaccines.

*These various projects have been funded through grants from the Oppenheimer Translational Research Program, the Susan G. Komen Breast Cancer Foundation, the Arthritis Foundation, the Wright Foundation, the American Cancer Society, and the NIH National Institute for Arthritis, Musculoskeletal and Skin Diseases.*

Additional collaborative projects in this research area:



- with Dr. Bernard Bochner (Memorial Sloan Kettering Cancer Center (MSKCC), NY), we have tested these anti-angiogenic vectors in bladder cancer models by minimally invasive intra-vesical instillation.
- with Dr. Sarah Hamm-Alvarez (USC), we contributed to characterizing some of the perturbations in cellular protein trafficking that occur during adenovirus vector infection of target cells.
- with Dr. David Woodley and Dr. Mei Chen (USC), we have utilized lentivirus vectors to correct the epithelial cell attachment defect in dystrophic epidermolysis bullosa by delivery of human collagen VII, encoding the anchoring fibril protein responsible for attachment of keratinocytes to the basement membrane.

## **2. Development of Viral Vectors Targeted to Specific Tissues or Cell Types**

We were among the first to demonstrate that retroviral vectors can be coated with envelope proteins that have been modified to contain targeting moieties. Such vectors have been shown to achieve tissue-specific targeting in principle, but their titers on targeted cells were significantly reduced, due to low efficiency in the critical process of virus-cell membrane fusion after binding via the heterologous targeting moiety. We previously tested strategies to augment virus-cell membrane fusion in re-targeted retrovirus vectors by incorporation of endosomolytic sequences derived from cell-penetrating peptides such as diphtheria toxin, kindly provided by Dr. David Eisenberg and Dr. Ralf Landgraf (UCLA). Recently, we developed a strategy for capturing target-specific antibodies onto retroviral envelopes engineered with the immunoglobulin binding domain of Staphylococcal Protein A, which we have used to target retrovirus vectors to breast cancer cells via anti-HER-2 antibodies, kindly provided by Dr. Michael Press (USC). We are also seeking to develop adenoviral vectors with novel targeting properties, e.g., by engineering adenovirus capsid proteins to bind specifically to human breast cancer cells via the HER-2 binding ligand heregulin.

*These projects have been funded through grants from the Cooley's Anemia Foundation, Department of Defense Breast Cancer Research Program, Susan G. Komen Breast Cancer Foundation, and a P01 project component from the NIH National Cancer Institute.*

### Additional collaborative projects in this area:

- In collaboration with Dr. Paula Cannon (Childrens Hospital Los Angeles) and Dr. W. French Anderson (Biochemistry, USC), we have also tested strategies to incorporate heterologous fusogenic viral envelope proteins to augment virus-cell membrane fusion of re-targeted retrovirus vectors.
- In collaboration with Dr. Lali Medina-Kauwe (Cedars-Sinai) and Dr. Laurence H. Kedes (USC), we helped to develop a non-viral protein-DNA polyplex vector system which utilizes HER2-targeted adenoviral capsid proteins directly conjugated to DNA, thereby taking advantage of adenovirus protein functions in cell entry.

## **3. Development of Novel Adenovirus-Retroelement Hybrid Vectors**

We were also the first to create novel vector systems that consist of hybrids of adenovirus and retrotransposon elements, and among the first to create hybrids of adenovirus and retrovirus/lentivirus. We have used helper-dependent ("guttled") adenoviral vectors to construct these hybrids. Since they are completely gutted, these adenovirus vectors now allow a cloning capacity of up to 35 kb, making it possible to insert a complete retroviral or lentiviral packaging system, or human LINE (L1) retrotransposon element.



This hybrid vector system therefore transduces cells by a two stage, "Trojan horse"-type mechanism: in the first (adenovirus) stage, the retroelements carried by the adenoviral vector will be expressed in the transduced cells, and in the second (retroelement) stage, the retroelements will either stably transduce additional adjacent cells (in the case of retrovirus inserts) or permanently integrate into the genome of the initially transduced cells (in the case of retrotransposon inserts). This retroelement-adenovirus (R-Ad) hybrid vector system will thus combine the most advantageous characteristics of both types of vectors, being capable of efficient high level transduction *in vivo* as well as stable integration into the genome.

Initially, the helper-dependent adenovirus vector components were kindly provided by our collaborator Dr. Kohnosuke Mitani (previously UCLA, currently Saitama Medical University, Japan), and recently Dr. Pedro Lowenstein (Cedars-Sinai) has generously provided a new helper virus system. Also for our development of retrotransposon-adenovirus hybrids, we would like to acknowledge our collaborators Dr. John Moran (Univ. of Michigan) and Dr. Haig Kazazian (Univ. of Pennsylvania), pioneers in the field of retrotransposon biology, who provided novel LINE constructs isolated from the human genome that we engineered into these adenovirus-based hybrid vectors.

*These projects have been funded primarily by an R21 grant from the NIH National Institute for Diabetes, Digestive, and Kidney Diseases, and an R01 grant from the National Cancer Institute.*

#### **4. Development of Tumor-Selectively Replication-Competent Retrovirus Vectors**

The use of replication-competent retroviral vectors for gene transfer would be more efficient than conventional replication-defective vectors, as each tumor cell that is successfully transduced would itself become a virus-producing cell, resulting in further transduction events even after the initial administration. Although murine leukemia virus (MLV)-based replication-competent retrovirus (RCR) vectors for delivery of non-viral genes have been described previously, none of these vectors proved to be stable, resulting in rapid rearrangement and deletion of the transgenes, usually within one or two replication cycles. We were the first to develop a novel construct design for MLV-RCR vectors that has proven to be highly stable over multiple serial passages in cell culture, and the first to demonstrate that such vectors are capable of highly efficient replicative spread and gene delivery throughout solid tumors *in vivo*.

In addition to this genomic stability issue which we have addressed, until now the use of such RCR vectors has rarely been contemplated due to the potential risks associated with uncontrolled viral spread. However, we demonstrated that the inability of MLV to infect quiescent cells results in an inherent selectivity for rapidly dividing tumor cells *in vivo*. Furthermore, incorporation of suicide genes in the vectors not only serves as a therapeutic strategy for tumor cell killing, but is also a "self-destruct" mechanism which provides an additional safeguard that minimizes the risk to normal cells, and represents a significant improvement in vector design. We have found that RCR vectors can achieve not only efficient but also persistent infection of solid tumors *in vivo*, allowing the virus to follow tumor cells even as they migrate and form metastatic foci. Furthermore, the efficient and long-term expression of viral neo-antigens displayed on the surface of infected tumor cells now provides opportunities for novel combinations of suicide gene therapy and follow-up immunotherapy.

To further enhance tumor-selectivity and safety, we are also developing targeting strategies for RCR vectors by (1) modification of viral binding tropism using cancer cell-specific ligands or by incorporation into targeted adenovirus-RCR hybrid vectors (*see Research Areas 2 and 3, above*), or by (2) transcriptional control of RCR replication using tissue-specific promoters. For the latter approach, we were the first to demonstrate tissue-specific transcriptional regulation of retroviral replication using the highly prostate-specific probasin promoter.



Our group at UCLA is now leading a multi-national consortium with collaborators at USC, CHLA, UCSF, Memorial Sloan Kettering Cancer Center, Hôpital Pitié-Salpêtrière in France, and the Virology Institute in Austria, which aims to pursue further testing of RCR vectors in tumor models, comparison of vector designs, and establishment of clinical-grade vector manufacturing for clinical trials now under discussion with the FDA. I have recently submitted a multi-institutional U01 grant proposal to develop clinical grade vector production and perform preclinical toxicology and efficacy studies, with the goal of IND filing and initiation of clinical trials to test the use of RCR vectors in brain tumors within the next 4 years.

*These projects have been funded primarily by grants from the Department of Defense Breast Cancer and Prostate Cancer Research Programs, and R01 grants from the NIH National Cancer Institute.*

#### **5. Development of strategies for genetic immunomodulation of stem cell-derived transplants:**

The overall goal of this project is to adapt and emulate the mechanisms used by tumors to evade or suppress the immune system, and apply them toward achieving long-term graft survival in cellular transplantation, particularly under conditions of sub-optimal histocompatibility (i.e., HLA mis-matched, allogeneic donor-derived grafts). In particular, we are among the first to develop siRNA targeted against HLA sequences in a pan-Class I-specific or allele-specific manner for selective HLA silencing to improve histocompatibility of stem cell transplantation, and we will proceed to testing combination strategies with allele-specific HLA silencing, co-stimulator silencing, and dominant negative immunoregulation methods in haploidentical and allogeneic transplantation models.

We are currently applying this approach to enhancing the histocompatibility of allogeneic donor-derived hematopoietic stem cell and bone marrow transplantation, and our goal is to extend its application to pancreatic islet cell transplants and skin grafts. Even silencing a single HLA allele can greatly increase the availability of suitable transplant donors, as this will nullify the need to match that particular allele. Furthermore, it is increasingly becoming apparent that human adult and embryonic stem cell-derived tissues, which do not initially express HLA, subsequently show increasing levels of HLA expression as they differentiate into mature tissues. Thus, any non-autologous adult stem cell-derived tissues and every embryonic stem cell-derived tissue will eventually encounter the same problems of immune rejection that have long confronted the field of adult organ transplantation, and we propose that this strategy may be an effective and fundamentally different approach to overcoming these problems, by genetically modifying graft cells to evade the immune system instead of immunosuppressing the host.

This strategy may also be applicable to adoptively transferred cytotoxic T lymphocyte (CTL) immunotherapy. One major drawback of adoptive immunotherapy is the need for customized cell products prepared from the patient's own autologous cells. However, I envision that tumor antigen-activated CTLs can be made "universal" by using siRNA to silence their endogenous HLA sequences, which will now allow the same CTL preparation to be used in multiple patients. In relation to our other areas of research, we are also seeking to further augment their potency by employing CTLs in a dual role, not only for direct tumor cell killing, but also by engineering them to become virus-producing cell carriers for tumor-targeted delivery of RCR and other oncolytic viral vectors.

*These projects have been funded by grants from the NIH-sponsored UCLA Center for Biological Radio-Protectors, and the California Institute of Regenerative Medicine.*



**RESEARCH GRANTS OBTAINED**

Targeted Retroviral Vectors for Mucosal Gene Transfer. James H. Zumberge Faculty Research and Innovation Fund, 1996-1997.	\$13,000
Gene Therapy for Rheumatoid Arthritis. Wright Foundation Research Award, 1996-1997.	\$40,000
Improving Retroviral Vectors for Gene Therapy of Ovarian Cancer. Ovarian Cancer Fund Research Award, 1996-1997.	\$20,000
Targeting Adenoviral Vectors to Cancer Cells. Margaret E. Early Medical Research Trust, 1997-1998.	\$49,050
A Novel System for Targeting Gene Delivery to Breast Cancer Cells. Susan G. Komen Breast Cancer Foundation, 1997-1998. <i>(as Co-Investigator; Principal Investigator: Dr. Laurence H. Kedes)</i>	\$150,000
Targeting Adenoviral Vectors to Cancer Cells. Margaret E. Early Medical Research Trust, 1998-1999 (competitive renewal).	\$50,810
Improving Retroviral Vectors for Gene Therapy of Breast Cancer. USC/Norris Breast Cancer Research Program, 1998.	\$24,923
Targeting Gene Delivery via the LDL Receptor. USC Liver Disease Research Center Pilot Project Program, 1998-1999.	\$23,938
USC Liver Disease Research Center New Investigator Award. USC Liver Disease Research Center Pilot Project Program, 1998-1999.	\$20,000
Improving Stem Cell-Targeted Gene Therapy for Thalassemia. Cooley's Anemia Foundation Research Fellowship Award, 1998.	\$27,270
Improving Retroviral Vectors for Gene Therapy of Prostate Cancer. USC/Norris Cancer Center Core Grant Translational Pilot Project Program, 1998-1999.	\$20,000
A Novel System for Targeting Gene Delivery to Breast Cancer Cells. Susan G. Komen Breast Cancer Foundation, 1998-2000 (competitive renewal). <i>(as Co-Investigator; Principal Investigator: Dr. Laurence H. Kedes)</i>	\$198,148
Development of Novel Adenovirus-Retroelement Hybrid Vectors. NIH grant #1 R21 DK054280-01 (NIDDK), 1998-2000.	\$241,935
Improving Stem Cell-Targeted Gene Therapy for Thalassemia. Cooley's Anemia Foundation Research Fellowship Award, 1999 (competitive renewal).	\$27,270
Development of Adenoviral Protein-DNA Conjugate Vectors. NIH grant #1 R41 CA81818-01 (NCI), 1999-2000.	\$99,773
Anti-Inflammatory Gene Therapy for Rheumatoid Arthritis. Arthritis Foundation Southern California Chapter grant, 1999-2000.	\$25,000
Anti-Angiogenic Gene Therapy for Rheumatoid Arthritis. NIH grant #1 R03 AR46366-01 (NIAMSD), 1999-2002	\$150,000



A Novel Gene Delivery System Targeted to Breast Cancer Cells. Department of Defense Breast Cancer Research Program grant #BC980325, 1999-2002. <i>(as Co-Investigator; Principal Investigator: Dr. Laurence H. Kedes)</i>	\$209,542
Improving Retroviral Vectors for Gene Therapy of Breast Cancer. Department of Defense Breast Cancer Research Program grant #DAMD17-99-1-9377, 1999-2002.	\$204,699
Investigating the Role of Klotho as a Humoral Factor Implicated in Age- Related Disease Pathogenesis. American Federation for Aging Research grant, 1999-2001.	\$39,999
Adenoviral-Mediated Anti-Angiogenic Gene Therapy for Bladder Cancer. American Cancer Society Research Project grant RPG-99-355-01-MGO, 1999-2002. <i>(as Co-Investigator; Principal Investigator: Dr. Bernard H. Bochner)</i>	\$375,000
Anti-Angiogenic Gene Therapy for Breast Cancer. Susan G. Komen Breast Cancer Foundation, 1999-2002. (fellowship for post-doctoral fellow in my lab)	\$105,935
Targeting Retroviral Gene Delivery to Breast Cancer. Susan G. Komen Breast Cancer Foundation, 1999-2001. (pre-doctoral fellowship for graduate student in my lab)	\$30,000
Improving Retroviral Vectors for Gene Therapy of Prostate Cancer. Department of Defense Prostate Cancer Research Program grant #DAMD17-00-1-0044, 2000-2002.	\$279,018
Targeted Delivery of an Anti-Breast Tumor Agent. California Breast Cancer Research Program grant 6EB-0059, 2000-2002. <i>(as Co-Investigator; Principal Investigator: Dr. Francis S. Markland, Jr., USC.)</i>	\$684,996
Transcriptional Targeting of Retroviral Replication to Tumors. NIH grant #R01 CA85908 (NCI), 2000-2004.	\$540,000
Gene Therapy for Dystrophic Epidermolysis Bullosa. NIH grant #R01 AR047981 (NIAMSD), 2001-2005. <i>(as Co-Investigator; Principal Investigator: Dr. Mei Chen, USC)</i>	\$800,000
Transcriptional Targeting of Retroviral Replication to Tumors.  (As a component (Project 2) of NCI Program Project Grant (PPG) application #P01 CA59318-07, "Improving Retroviral Vectors for Gene Delivery," Program Director: Laurence H. Kedes, 2001-2007. This project is identical to the above R01, therefore we chose to relinquish the R01 and instead receive funding through the PPG mechanism.)	\$1,528,000



Investigating the Role of Klotho in Age-Related Disease Pathogenesis. Wright Foundation Research Award, 2001-2002.	\$40,000
Cellular Transduction by Retrotransposon-Adenovirus Hybrid Vectors. NIH grant #R01 CA93709 (NCI), 2002-2007.	\$812,000
Hybrid adenovirus-lentivirus vectors for cancer gene therapy. UCLA Gene Medicine Training Program (# T32 CA75956), 2004-2006. <i>fellowship for post-doctoral fellow in my lab, Program Director: Dr. James Economou, UCLA</i>	\$106,000
Therapeutic Applications in Cancer Therapy. UCLA Scholars in Oncologic Molecular Imaging Program (# R25T CA098010), 2004-2006. <i>(fellowship for post-doctoral fellow in my lab, Program Director: Dr. Anna Wu, UCLA)</i>	\$120,000
Combining Oncolytic Virotherapy and Immunotherapy for Cancer. NIH grant #R01 CA105171 (NCI), 2004-2009.	\$1,025,000
Replication Competent Retrovirus Vectors Based on Gibbon Ape Leukemia Virus. UCLA Interdisciplinary Training in Virology and Gene Therapy (# T32 AI060567), 2004-2007 <i>fellowship for pre-doctoral fellow in my lab, Program Director: Dr. Irvin Chen, UCLA</i>	\$68,316
Molecular Biology/ Gene Transfer Vector Core. CURE/ Digestive Diseases Research Center (#P30 DK041301), 2004-2009 <i>(as Core Director; Center Director: Dr. Enrique Rozengurt, UCLA)</i>	\$230,000
Shared Resource / UCLA Vector Core. UCLA Jonsson Comprehensive Cancer Center, Charlotte Endowment Fund, 2004-2009. <i>(as Core Director; Center Director: Dr. Judith Gasson, UCLA)</i>	\$100,000
HIV Infection in the GI Tract: Cellular Portals and Microbicidal Inhibition. UCLA AIDS Research Institute seed grant, 2005-2006. <i>(as Co-Investigator; Principal Investigator: Dr. Ian McGowan, UCLA.)</i>	\$50,000
Targeting Retrovirus Replication for Gene Therapy of Breast Cancer. Susan G. Komen Breast Cancer Foundation (# PDF 0503958), 2005-2008. <i>(fellowship for post-doctoral fellow in my lab)</i>	\$105,000
Cellular Transduction with Replication-Competent Retrovirus Vectors. Charlotte Geyer Foundation, 2006-2007.	\$100,000
A Strategy for Hematopoietic Radioprotection by Reduction of Histocompatibility Barriers. UCLA Center for Biological Radioprotectors (# U19 AI067769, Center Director: William McBride), 2006-2007.	\$50,000



- Cellular Transduction with Replication-Competent Retrovirus Vectors. \$1,940,143  
NIH grant #R01 CA121258 (NCI), 2007-2012.
- A Strategy for Hematopoietic Radioprotection by Reduction of Histocompatibility Barriers. \$65,000  
UCLA Center for Biological Radioprotectors (# U19 AI067769, Center Director: William McBride), competing renewal 2007-2008.
- Down-Regulation of Alloreactive Immune Responses to hES Cell-Derived Graft Tissues. \$370,772  
California Institute for Regenerative Medicine (SEED grant #RS1-00402-1), 2007-2009.
- Translational Development of Autologous Cell Vaccines for Leukemia. \$30,000  
Oppenheimer Program Clinical Translational Seed Grant Program, 2008-2009.
- Vioreplicative Gene Therapy Targeted to Prostate Cancer. \$375,000  
Department of Defense Prostate Cancer Research Program - Idea Award, 2008-2010.  
(Funding recommended, pending receipt of award funds)

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2. **Kasahara, N.**, Dozy, A., Kan, Y.W. Targeted gene delivery by retroviruses with peptide hormone sequences engineered into the envelope.

(Abstract presented at the UCLA Symposium on Gene Therapy, Keystone, CO, April 12-18, 1993.)

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5. Han, X., **Kasahara, N.**, Kan, Y.W.

Ligand-mediated retroviral targeting to human breast cancer cells.

(Abstract presented at the Cold Spring Harbor Symposium on Gene Therapy, Cold Spring Harbor, NY, September 21-25, 1994. )



6. Wong, C., **Kasahara, N.**, Cowan, M. J., Kan, Y.W.  
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13. Wu, W., Empig, C., Zhao, Y., Cannon, P., **Kasahara, N.**



Investigating mechanisms of entry by retroviral vectors targeted to the LDL receptor.

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14. Logg, C. L., Gordon, E. M., **Kasahara, N.**

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(Abstract presented at the Fourth West Coast Retrovirus Meeting, Newport Beach, California, October 2-4, 1997.)

15. Higo, C., Jih, L., Chan, R., Mitani, K., **Kasahara, N.**

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16. Medina-Kauwe, L., **Kasahara, N.**, Kedes, L.

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41. Chang, Z., Pan, J., Logg, C., **Kasahara, N.**, Roy-Burman, P.

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48. Kaissi, S., Harboe-Schmidt, J.-E., Kuro-o, M., **Kasahara, N.**  
Investigating the role of Klotho as a humoral factor implicated in age-related disease pathogenesis.  
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56. Ngiam, C., Barcova, M., Jih, L., Faure, E., Kim, J. H., Shichinohe, T., Mitani, K., Stripecke, R., Cannon, P. M., **Kasahara, N.**

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62. Shichinohe, T., Sazawa, A., Kim, J. H., Tai, C. K., Mizutani, K., Bochner, B. H., **Kasahara, N.**

Lentivirus-vector mediated antiangiogenic gene therapy with thrombospondin-1 and endostatin result in suppression of tumor growth *in vivo*.

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70. Logg, C. R., Logg, A., Tai, C. K., Wang, W., Chen, T., Bochner, B. H., **Kasahara, N.**

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A novel system for targeting gene delivery to breast cancer cells.

(Abstract presented at the Department of Defense Breast Cancer Research Program Era of Hope Meeting, Orlando, Florida, September 25-28, 2002.)

76. Tai, C. K., Wang, W., Sazawa, A., Kim, J. H., Logg, C. R., Park, J., Press, M., Anderson, W. F., Cannon, P. M., Stripecke, R., Faure, E., Margalit, R., Bochner, B. H., Chen, T. **Kasahara, N.**

Therapeutic efficacy of highly efficient and tumor-restricted gene transfer *in vivo* by replication-competent retroviral vectors.

(Abstract presented at the 10<sup>th</sup> annual meeting of the European Society of Gene Therapy, Antibes Juan-les Pins, France, October 12-16, 2002.)

77. Faure, E., Jih, L., Barcova, M., Ngiam, C., Kim, J. H., Soifer, H., Sazawa, A., Shichinohe, T., Lowenstein, P., Castro, M., Anderson, W. F., Cannon, P. M., Stripecke, R., **Kasahara, N.**, Margalit, R.

The *HyVec* system: hybrid adenovirus-retro/lentivirus vectors utilizing a two-stage mechanism for efficient gene transfer and stable integration.

(Abstract presented at the 10<sup>th</sup> annual meeting of the European Society of Gene Therapy, Antibes Juan-les Pins, France, October 12-16, 2002.)

78. Chen, T. C., Wang, W. J., Tai, C. K., **Kasahara, N.**

Use of replication competent retroviruses containing the suicide gene cytosine deaminase in the treatment of malignant gliomas.

(Abstract presented at the annual meeting of the American Academy of Neurological Surgeons, Scottsdale, Arizona, October 2002.)

79. Nakamura, S., Nakamura, R., Kobayashi, M., Naito, K., Takeshita, A., Ohnishi, K., Kasahara, N., Iwaki, Y.

Development of novel packaging cell lines for generation of adeno-associated virus vectors by lentiviral gene transfer of trans-complementary components.

(Abstract presented at the 44th Annual Meeting of the American Society of Hematology, Philadelphia, PA, December 6-10, 2002.)

*Blood* 100(11): Abstract No. 2570, 2002..

80. Tai, C. K., Wang, W., Chen, T. C., Sazawa, A., Faure, E., Logg, C. R., Bochner, B. H., Yoon, L. T. K., Lee, A. S., Cannon, P. M., Anderson, W. F., **Kasahara, N.**

Development of replication-competent retrovirus vectors for cancer gene therapy: *in vivo* therapeutic efficacy, tumor-selectivity, and safety.

(Abstract selected for oral presentation at the 11<sup>th</sup> International Conference on Gene Therapy of Cancer, San Diego, California, December 12-14, 2002.)

81. Tai, C. K., Wang, W., Logg, C., Chen, T. C., **Kasahara, N.**

Highly efficient cell killing *in vitro* and *in vivo* by replication-competent retroviral vectors expressing cytosine deaminase and purine nucleoside phosphorylase.



(Abstract selected for oral presentation at the 11<sup>th</sup> International Conference on Gene Therapy of Cancer, San Diego, California, December 12-14, 2002.)

82. Sazawa, A., Shichinohe, T., Kim, J. H., Mizutani, K., Iwaki, Y., Bochner, B. H., **Kasahara, N.**

Lentivirus-mediated gene transfer for combination anti-angiogenic therapy of solid tumors.

(Abstract selected for oral presentation at the 11<sup>th</sup> International Conference on Gene Therapy of Cancer, San Diego, California, December 12-14, 2002.)

83. Logg, C. R., Logg, A., Matusik, R. J., Bochner, B. H., **Kasahara, N.**

Transcriptional control of retrovirus vector replication to achieve highly efficient and tumor cell-specific gene transfer.

(Abstract selected for oral presentation at the 4<sup>th</sup> Cold Spring Harbor Biotechnology Symposium on Vector Targeting Strategies for Therapeutic Gene Delivery, Cold Spring Harbor, New York, March 20-23, 2003.)

84. Tai, C. K., Wang, W., Logg, C. R., Sazawa, A., Faure, E., Anderson, W. F., Chen, T. C., **Kasahara, N.**

Replication-competent retrovirus vector-mediated cancer gene therapy: highly efficient and tumor-specific transfer of suicide genes *in vivo* resulting in tumor eradication and long-term survival.

(Abstract selected for oral presentation at the 6th Annual Meeting of the American Society of Gene Therapy, Washington D.C., June 4-8, 2003.)

85. Wang, W., Sosnowski, B., Chua, J., **Kasahara, N.**, Bergelson, J. M., Chen, T. C.

Optimization of adenoviral vector transduction in human malignant gliomas.

(Abstract selected for oral presentation at the 6th Annual Meeting of the American Society of Gene Therapy, Washington D.C., June 4-8, 2003.)

86. Ohori, M., Kikuchi, E., Menendez, S., Logg, C. R., Juan, G., Matusik, R., Cordon-Cardo, C., **Kasahara, N.**, Bochner, B. H.

Probasin-targeted replication-competent retrovirus vectors achieve highly efficient and prostate cancer-specific gene transfer *in vivo*.

(Abstract selected for oral presentation at the 6th Annual Meeting of the American Society of Gene Therapy, Washington D.C., June 4-8, 2003.)

87. Kikuchi, E., Ohori, M., Menendez, S., Cordon-Cardo, C., **Kasahara, N.**, Bochner, B. H.

Intravesically administered replication-competent retroviral vectors are highly efficient delivery vehicles for bladder cancer gene therapy.

(Abstract presented at the 6th Annual Meeting of the American Society of Gene Therapy, Washington D.C., June 4-8, 2003.)

88. Sazawa, A., Shichinohe, T., Kim, J. H., Mizutani, K., Iwaki, Y., Bochner, B. H., **Kasahara, N.**



Lentivirus-mediated gene transfer for combination anti-angiogenic therapy of solid tumors.

(Abstract presented at the 6th Annual Meeting of the American Society of Gene Therapy, Washington D.C., June 4-8, 2003.)

89. Hallak, L. K., Zhang, J., **Kasahara, N.**, Russell, S. J.

Generation of sterically blocked protease-activatable vectors.

(Abstract presented at the 6th Annual Meeting of the American Society of Gene Therapy, Washington D.C., June 4-8, 2003.)

90. Ta, H. Q., Koya, R. C., **Kasahara, N.**, Weber, J., Levine, A. M., Stripecke, R.

**Self-inactivating lentiviral vectors efficiently achieve simultaneous co-delivery of GM-CSF, CD80, IL-4 and CD40L genes into primary acute myeloid leukemia cells to re-program their differentiation into antigen-presenting cells.**

(Abstract presented at the 6th Annual Meeting of the American Society of Gene Therapy, Washington D.C., June 4-8, 2003.)

91. Kikuchi, E., Menendez, S., Ohori, M., Cordon-Cardo, C., **Kasahara, N.**, Bochner, B. H.

Effect of lentiviral gene transfer of endostatin on orthotopic growth of human bladder tumors.

(Abstract presented at the 94th Annual Meeting of the American Association for Cancer Research, Washington D.C., July 11-14, 2003.)

92. Tai, C. K., Wang, W., Sazawa, A., Logg, C. R., Logg, A., Ohori, M., Kikuchi, E., Bochner, B. H., Chen, T., **Kasahara, N.**

Tumor-selectively replicating retrovirus vectors achieve highly efficient intratumoral therapeutic gene transfer and long term survival benefit *in vivo*.

(Abstract selected for oral presentation at the 9th Annual Meeting of the Japan Society of Gene Therapy, Tokyo, Japan, July 19-21, 2003.)

93. Tai, C. K., Wang, W., Logg, C. R., Chen, T., **Kasahara, N.**

Replication-competent retrovirus vectors for oncolytic therapy of gliomas: highly efficient suicide gene transfer and stable expression results in long-term survival benefit *in vivo*.

(Abstract selected for oral presentation at the 8th Annual Meeting of the Society for Neuro-Oncology, Keystone, Colorado, November 13-16, 2003.)

94. Tai, C. K., Wang, W., Solly, S., Frisen, C., Logg, C., Klatzmann, D., Chen, T. C., **Kasahara, N.**

Essential role of genomic integration and anti-viral immune response for the *in vivo* therapeutic efficacy and safety of cancer gene therapy with tumor-selective replication-competent retrovirus vectors.

(Abstract selected for oral presentation at the 12<sup>th</sup> International Conference on Gene Therapy of Cancer, San Diego, California, December 13-15, 2003.)



95. Tai, C. K., Wang, W., Logg, C., Solly, S., Frisen, C., Eiden, M. V., Klatzmann, D., Chen, T. C., **Kasahara, N.**

Replication-competent retrovirus vectors for cancer gene therapy: *in vivo* therapeutic efficacy and safety.

(Abstract presented at the 2004 International Society of Cancer Gene Therapy meeting, Singapore, Malaysia, February 20-23, 2004.)

96. Hiraoka, K., Tai, C. K., Logg, C., Katoh, H., **Kasahara, N.**

High efficiency suicide gene therapy for colon cancer using replication-competent retrovirus vectors.

(Abstract presented at the 2004 International Society of Cancer Gene Therapy meeting, Singapore, Malaysia, February 20-23, 2004.)

97. Kubo, S., Faure, E., Soifer, H., Jih, L. J.-L., Ngiam, C., Barcova, M., Kim, J.-H., Stripecke, R., Cannon, P. M., **Kasahara, N.**

High-capacity adenovirus/lentivirus hybrid vectors for efficient and stable gene transfer via a two-stage mechanism.

(Abstract presented at the 2004 International Society of Cancer Gene Therapy meeting, Singapore, Malaysia, February 20-23, 2004.)

98. Hauschulz, K., Seefried, S., Schenk, A., Smirnow, I., Wybranietz, W., **Kasahara, N.**, Bitzer, M., Lauer U. M.

Generation and evaluation of a new replication-competent retrovirus (RCR) vector coding for the SuperCD suicide gene.

(Abstract presented at the 7th Annual Meeting of the American Society of Gene Therapy, Minneapolis, MN, June 2-6, 2004.)

99. Kubo, S., Soifer, H., Moran, J. V., Kazazian, Jr., H. H., **Kasahara, N.**

High-capacity adenovirus/retrotransposon hybrid vectors for efficient and stable gene transfer.

(Abstract presented at the 7th Annual Meeting of the American Society of Gene Therapy, Minneapolis, MN, June 2-6, 2004.)

100. Wang, W., Tai, C.-K., Kershaw, A.D., Solly, S.K., Klatzmann, D., **Kasahara, N.**, Chen, T.C.

RCR vectors mediated gene therapy for malignant gliomas.

(Abstract presented at the 9th Annual Meeting of the Society for Neuro-Oncology, Toronto, Canada, November 18-21, 2004.)

101. Tai, C.-K., Wang, W., Logg, C. R., Parker, W. B., Hong, J. S., Li, Y.-F., Sorscher, E. J., Chen, T. C., **Kasahara, N.**

Gene therapy for malignant gliomas by high efficiency retrovirus vector expressing *Escherichia coli* purine nucleoside phosphorylase.



(Abstract presented at the 96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 16-20, 2005.)

102. Ozu, C., Kikuchi, E., Ohori, M., Menendez, S., Cordon-Cardo, C., Logg, C. R., **Kasahara, N.**, Bochner, B. H.

Tissue-specific gene therapy for prostate cancer by a probasin promoter driven replication-competent retroviral vector.

(Abstract presented at the 96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 16-20, 2005.)

103. Koya, R. C., **Kasahara, N.**, Kimura, T., Ribas, A., Stripecke, R.

**Immunostimulatory efficiency of dendritic cells generated by lentiviral transduction of cytokines against melanoma.**

(Abstract presented at the 96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 16-20, 2005.)

104. Ramamurthy, B., Veena, M. S., Ramalingam, T. S., Hiraoka, K., **Kasahara, N.**, Wang, M. B., Srivatsan, E.S.

Nuclear p16 gene expression correlates with cisplatin sensitivity in SCCHN.

(Abstract presented at the 96th Annual Meeting of the American Association for Cancer Research, Anaheim, CA, April 16-20, 2005.)

105. Hiraoka, K., Kimura, T., Logg, C., Kondo, S., **Kasahara, N.**

Highly efficient and tumor-selective gene delivery in metastatic colon cancer models using a replication-competent retrovirus vector.

(Abstract presented at the 8th Annual Meeting of the American Society of Gene Therapy, St. Louis, Missouri, June 1-5, 2005.)

106. Ozu, C., Kikuchi, E., Menendez, S., Cordon-Cardo, C., Logg, C. R., **Kasahara, N.**, Bochner, B. H.

Tissue-specific gene therapy by replication-competent retroviral vector for prostate cancer with fludarabine phosphate.

(Abstract presented at the 8th Annual Meeting of the American Society of Gene Therapy, St. Louis, Missouri, June 1-5, 2005.)

107. Koya, R. C., Kimura, T., **Kasahara, N.**, Ribas, A., Stripecke, R.

Higher *in vivo* maintenance, biodistribution and immunopotency of dendritic cell vaccines self-differentiated through lentiviral vector programming.

(Abstract selected for oral presentation at the 8th Annual Meeting of the American Society of Gene Therapy, St. Louis, Missouri, June 1-5, 2005.)

108. Koya, R. C., Zheng, Y., Faure, E., Yu, G.-Y., Kimura, T., **Kasahara, N.**, Stripecke, R.



Lentiviral vector mediated genetic modification of dendritic cells as a vaccine against hepatitis c.

(Abstract presented at the 8th Annual Meeting of the American Society of Gene Therapy, St. Louis, Missouri, June 1-5, 2005.)

109. Kimura, T., Koya, R. C., **Kasahara, N.**, Stripecke, R.

Bio-distribution studies of lentiviral vectors injected intravenously by dynamic bioluminescence imaging analyses: development of APC-transcriptionally targeted vectors for genetic vaccination purposes.

(Abstract presented at the 8th Annual Meeting of the American Society of Gene Therapy, St. Louis, Missouri, June 1-5, 2005.)

110. Kubo, S., Soifer, H. S., Seleme, M. C., Moran, J. V., Kazazian, Jr., H. H., **Kasahara, N.**

An adenovirus-retrotransposon hybrid vector achieves stable transformation of quiescent and primary human somatic cells.

(Abstract selected for oral presentation at the 8th Annual Meeting of the American Society of Gene Therapy, St. Louis, Missouri, June 1-5, 2005.)

111. Hiraoka, K., Kimura, T., Logg, C., Kondo, S., **Kasahara, N.**

Tumor-selective gene expression in hepatic metastasis using a replication-competent retrovirus (RCR) vector.

(Abstract selected for oral presentation at the 11th Annual Meeting of the Japan Society of Gene Therapy, Tokyo, Japan, July 28-30, 2005.)

112. Kubo, S., Kataoka, M., Tateno C., Palmer, D. J., Ng, P., Yoshizato, K., **Kasahara, N.**

*In vivo* stable transduction of humanized liver tissue in chimeric mice via high-capacity adenovirus- lentivirus hybrid vector.

(Abstract selected for oral presentation at the 11th Annual Meeting of the Japan Society of Gene Therapy, Tokyo, Japan, July 28-30, 2005.)

113. Kubo, S., Soifer, H. S., Seleme, M. C., Moran, J. V., Kazazian, Jr., H. H., **Kasahara, N.**

L1 retrotransposition in quiescent and primary human somatic cells and in the mouse liver parenchyma after efficient transduction with an adenovirus-retrotransposon hybrid.

(Abstract selected for oral presentation at the 11th Annual Meeting of the Japan Society of Gene Therapy, Tokyo, Japan, July 28-30, 2005.)

114. Hiraoka, K., Kimura, T., Logg, C., **Kasahara, N.**

Locoregional administration of replication-competent retrovirus vector achieves multifocal tumor-restricted viral propagation and efficient gene transfer in an immunocompetent hepatic metastasis model of colorectal cancer.

(Abstract presented at the 97th Annual Meeting of the American Association for Cancer Research, Washington DC, April 1-5, 2006.)



115. Haga, K., Gomez, G. G., Logg, C. R., Kimura, T., Hiraoka, K., Koya, R. C., Kruse, C. A., **Kasahara, N.**

Alloreactive cytotoxic T lymphocytes engineered as RCR vector producer cells for cellular delivery: Combined cellular and gene therapy for gliomas.

(Abstract presented at the 97th Annual Meeting of the American Association for Cancer Research, Washington DC, April 1-5, 2006.)

116. Kimura, T., Logg, C., Hiraoka, K., Haga, K., Koya, R. C., Matusik, R., Bochner, B., Stripecke, R., **Kasahara, N.**

Transcriptional targeting and pseudotyping of RCR vectors improves the selectivity and efficiency of viral replication and tumor transduction in prostate cancer models.

(Abstract selected for oral presentation at the 97th Annual Meeting of the American Association for Cancer Research, Washington DC, April 1-5, 2006.)

117. Harboe, E., **Kasahara, N.**, McGowan, I.

Use of Lentiviral Vectors to Define Target Cells in Mucosal Explants.

(Abstract presented at the Microbicides 2006 Conference, Cape Town, South Africa, April 23-26, 2006.)

118. Kubo, S., Haga, K., **Kasahara, N.**

Enhancement of Transduction with Replication-Competent Retrovirus Vectors Using Helper-Dependent Adenovirus.

(Abstract presented at the 9th Annual Meeting of the American Society of Gene Therapy, Baltimore, Maryland, May 31-June 4, 2006.)

119. Kubo, S., Kataoka, M., Tateno C., Kimura, T., Palmer, D. J., Ng, P., Yoshizato, K., **Kasahara, N.**

A high-capacity adenovirus- lentivirus hybrid vector achieves stable transduction *in vivo* in a unique mouse model of humanized chimeric liver.

(Abstract presented at the 9th Annual Meeting of the American Society of Gene Therapy, Baltimore, Maryland, May 31-June 4, 2006.)

120. Kimura, T., Wang, H., Koya, R., Faure, E., Prins, R., Comin-Anduix, B., Cui, Y., **Kasahara, N.**, Stripecke, R.

Non-invasive dynamic optical imaging and immunological analyses of CMV vs. MHCII promoter regulated lentiviral vectors administered *in vivo*.

(Abstract presented at the 9th Annual Meeting of the American Society of Gene Therapy, Baltimore, Maryland, May 31-June 4, 2006.)

121. Cicciarelli, J., **Kasahara, N.**, Logg, C., Mendez, R.

Permanent, lowered HLA Class I expression using lentivirus vectors with siRNA constructs.

(Abstract presented at the 2006 World Transplant Congress, Boston, Massachusetts, July 22-27, 2006.)



122. Haga, K., Gomez, G. G., Logg, C. R., Kimura, T., Hiraoka, K., Koya, R. C., Chen, T. C., Liau, L. M., Kruse, C. A., **Kasahara, N.**

Combined Adoptive Immunotherapy and Suicide Gene Therapy for Gliomas Using Alloreactive Cytotoxic T Lymphocytes as Replication-Competent Retrovirus Vector Producer Cells.

(Abstract presented at the 2006 International Society of Cancer Gene Therapy meeting, Chiba, Japan, October 13-15, 2006.)

123. Hiraoka, K., Kimura, T., Logg, C. R., Haga, K., Kondo, S., **Kasahara, N.**

Highly efficient gene delivery by locoregional administration of replication-competent retrovirus vectors in an immunocompetent model of metastatic colorectal cancer.

(Abstract presented at the 2006 International Society of Cancer Gene Therapy meeting, Chiba, Japan, October 13-15, 2006.)

124. Kimura, T., Logg, C. R., Hiraoka, K., Haga, K., Lawson, G.W., Matusik, R., Bochner, B., Egawa, S., Stripecke, R., **Kasahara, N.**

Control of Extratumoral Dissemination by Replication-Competent Retrovirus Vectors through Transcriptional Targeting to Prostate Cancer.

(Abstract presented at the 2006 International Society of Cancer Gene Therapy meeting, Chiba, Japan, October 13-15, 2006.)

125. Kubo, S., Haga, K., **Kasahara, N.**

Enhancement of Tumor Transduction with Replication-Competent Retrovirus Vectors Using Helper-dependent Adenovirus.

(Abstract presented at the 2006 International Society of Cancer Gene Therapy meeting, Chiba, Japan, October 13-15, 2006.)

126. Haga, K., Gomez, G. G., Logg, C. R., Kimura, T., Hiraoka, K., Chen, T. C., Liau, L. M., Kruse, C. A., **Kasahara, N.**

Alloreactive cytotoxic T lymphocytes (alloCTL) engineered as replication competent retrovirus (RCR) vector producer cells.

(Abstract presented at the Society for Neuro-Oncology (SNO) 11th annual meeting, Orlando, Florida, Nov. 16-19, 2006.)

127. Hiraoka, K., Kimura, T., Logg, C. R., Haga, K., **Kasahara, N.**

Locoregional administration of replication-competent retrovirus vectors in an immunocompetent model of metastatic colorectal cancer.

(Abstract presented at the 7th American Association for Cancer Research –Japanese Cancer Association Joint International Conference: In the Forefront of Basic and Translational Cancer Research, in Waikoloa, Hawaii, January 21 - 25, 2007.)

128. Haga, K., Gomez, G. G., Logg, C. R., Kimura, T., Hiraoka, K., Chen, T. C., Liau, L. M., Kruse, C. A., **Kasahara, N.**



Adoptive Immunotherapy using Alloreactive Cytotoxic T Lymphocytes as Virus Producer Cells Combined with Suicide Gene Therapy using Replication-Competent Retrovirus vectors for Human Gliomas.

(Abstract presented at the 7th American Association for Cancer Research –Japanese Cancer Association Joint International Conference: In the Forefront of Basic and Translational Cancer Research, in Waikoloa, Hawaii, January 21 - 25, 2007.)

129. Logg, C. R., Baranick, B., Lemp, N. A., **Kasahara, N.**

Adaptive evolution of a chimeric gammaretrovirus reveals novel *cis*-acting elements that modulate splicing.

(Abstract presented at the 4th International Conference on Oncolytic Viruses as Cancer Therapeutics, Scottsdale, Arizona, March 14-17, 2007)

130. Hung, T. K., Haga, K., Hiraoka, K., Logg, C., **Kasahara, N.**

Suicide gene therapy with replication-competent retrovirus (RCR) vectors combined with doxorubicin chemotherapy shows enhanced killing of human breast cancer cells.

(Abstract presented at the 98th Annual Meeting of the American Association for Cancer Research, Los Angeles, CA, April 14-18, 2007)

131. Haga, K., Gomez, G. G., Logg, C. R., Kimura, T., Hiraoka, K., Chen, T. C., Liau, L. M., Kruse, C. A., **Kasahara, N.**

Suicide gene therapy combined with adoptive immunotherapy for human gliomas using alloreactive T lymphocytes as producer cells for replication-competent retrovirus vectors.

(Abstract presented at the 98th Annual Meeting of the American Association for Cancer Research, Los Angeles, CA, April 14-18, 2007)

132. Haga, K., Lemp, N. A., Logg, C. R., Nagashima, J., Faure-Kumar, E., Gomez, G. G., Mendez, R., Stripecke, R., Kruse, C. A., Cicciarelli, J., **Kasahara, N.**

HLA Class I silencing by lentiviral vector-mediated shRNA delivery averts cytotoxicity by alloreactive T lymphocytes.

(Abstract presented at the American Urological Association (AUA) 2007 annual meeting, Anaheim, CA, May 19-24, 2007.)

133. Kimura, T., Haga, K., Logg, C. R., Hiraoka, K., Lawson, G.W., Matusik, R., Bochner, B., Egawa, S., Stripecke, R., **Kasahara, N.**

Transcriptional Targeting Achieves Effective Control of Systemic Dissemination by Replication-Competent Retrovirus.

(Abstract presented at the 10th Annual Meeting of the American Society of Gene Therapy, Seattle, Washington, May 30 - June 3, 2007.)

134. Kubo, S., Haga, K., Gotoh, A., **Kasahara, N.**

Enhancement of Therapeutic Effect with Replication-Competent Retrovirus Vectors Using Helper-dependent Adenovirus.



(Abstract presented at the 10th Annual Meeting of the American Society of Gene Therapy, Seattle, Washington, May 30 - June 3, 2007.)

135. Hiraoka, K., Kimura, T., Ohno, I., Logg, C., Haga, K., Shichinohe, T., Miyamoto, M., Hirano, S., Kondo, S., **Kasahara, N.**

Replication-Competent Retrovirus Vector -Mediated Suicide Gene Therapy in a Multifocal Liver Metastasis Model of Colorectal Cancer.

(Abstract presented at the 13th Annual Meeting of the Japan Society of Gene Therapy, Nagoya, Japan; June 28-30, 2007.)

136. Kimura, T., Koya, R. C., Faure-Kumar, E., Prins, R. M., Comin-Anduix, B., Ohashi, T., Eto, Y., Egawa, S., **Kasahara, N.**, Stripecke, R.  
Comparison of Effect of Lentiviral Vectors containing CMV or MHCII Promoter after Intravenous Administration for Genetic Vaccination.

(Abstract presented at the 13th Annual Meeting of the Japan Society of Gene Therapy, Nagoya, Japan; June 28-30, 2007.)

137. Logg, C. R., Baranick, B., Haga, K., Kimura, T., Lemp, N., Ohno, I., Bochner, B., Lin, A., Kruse, C., **Kasahara, N.**

Overcoming in vivo barriers to cancer gene therapy with replication-competent retrovirus vectors.

(Abstract presented at the 2007 Cold Spring Harbor Lab biotechnology conference on "In Vivo Barriers to Gene Delivery", Cold Spring Harbor, New York, November 26 - 29, 2007.)

138. Ohno, I., Haga, K., Wang, W., Tai, C. K., C., **Kasahara, N.**

APOBEC3 upregulation mediates cancer resistance after successful suicide gene therapy with replication-competent retrovirus vectors.

(Abstract presented at the 2007 Cold Spring Harbor Lab biotechnology conference on "In Vivo Barriers to Gene Delivery", Cold Spring Harbor, New York, November 26 - 29, 2007.)

139. Haga, K., Tomioka, A., Liao, C.-P., Kimura, T., Logg, C. R., Matsumoto, H., Ohno, I., Hermann, K., Tanaka, M., Uemura, H., Hirao, Y., Roy-Burman, P., **Kasahara, N.**

Suicide gene therapy using replication-competent retrovirus (RCR) combined with tumor-specific cytotoxic T lymphocytes (CTLs) for PTEN knock-out spontaneous prostate cancer model.

(Abstract presented at the American Urological Association (AUA) 2007 annual meeting, Orlando, Florida, May 17-22, 2008.)

140. Haga, K., Gomez, G. G., Logg, C. R., Kimura, T., Hiraoka, K., Matsumoto, H., Ohno, I., Lin, A., Kruse, C. A., **Kasahara, N.**

Combination gene and immunotherapy using alloreactive T lymphocytes as producer cells for replication-competent retrovirus vectors in a human glioma xenograft model.

(Abstract selected for oral presentation at the 11th Annual Meeting of the American Society of Gene Therapy, Boston, Massachusetts, May 28-June 1, 2008.)

141. Kubo, S., Moran, J. V., Kazazian, Jr., H. H., Okamura, H., **Kasahara, N.**



L1 retrotransposition in primary somatic cells and in the mouse liver parenchyma after efficient transduction with an adenovirus-retrotransposon hybrid vector.

(Abstract selected for oral presentation at the 11th Annual Meeting of the American Society of Gene Therapy, Boston, Massachusetts, May 28-June 1, 2008.)

142. Magnusson, M. K., Myhre, S., Ohno, I., Habib, N. A., **Kasahara, N.**, Lindholm, L.  
A transductionally re-targeted adenovirus vector for treatment of Her2/neu -positive tumours.

(Abstract presented at the 11th Annual Meeting of the American Society of Gene Therapy, Boston, Massachusetts, May 28-June 1, 2008.)

143. Haga, K., Gomez, G. G., Logg, C. R., Kimura, T., Hiraoka, K., Matsumoto, H., Ohno, I., Lin, A., Kruse, C. A., **Kasahara, N.**

Combination therapy using alloreactive T lymphocytes as producer cells for replication-competent retrovirus vectors in a human glioma xenograft model.

(Abstract selected for oral presentation at the 14th Annual Meeting of the Japan Society of Gene Therapy, Sapporo, Japan; June 12-14, 2008.)

144. Kimura, T., Hiraoka, K., Haga, K., Kiyota, H., Ohashi, T., Eto, Y., Egawa, S., **Kasahara, N.**

Improvement of transduction efficiency of RCR vectors by complexation of polybrene and chondroitin sulfate C.

(Abstract selected for oral presentation at the 14th Annual Meeting of the Japan Society of Gene Therapy, Sapporo, Japan; June 12-14, 2008.)

145. Cicciarelli, J., Lemp, N., Houston, K., Rhodes, C., Musa, S., Haga, K., Logg, C., Faure-Kumar, E., Lin, A., Stripecke, R., Mendez, R., Kruse, C., **Kasahara, N.**

Silencing of HLA Class I Expression by Lentivirus Vector-mediated RNA Interference Results in Resistance of Primary Human Cells to Alloreactive T Cell-Mediated Cytotoxicity.

(Abstract accepted for oral presentation at the XXII International Congress of The Transplantation Society, Sydney, Australia, August 10-14, 2008.)

146. Cho, Y. W., Cicciarelli J. C., Koss, M., Houston, K., Mendez, R., **Kasahara, N.**, Hutchinson, I. V., Shah, T.

Association between de novo Donor Specific HLA Antibody, C4d staining in renal graft biopsy, and Graft Outcome.

(Abstract accepted for oral presentation at the XXII International Congress of The Transplantation Society, Sydney, Australia, August 10-14, 2008.)

147. Lin, A.H., Hickey, M.J., Mueller, B.M., Haga, K., **Kasahara, N.**, Kruse, C.A..

Immune and gene therapies for breast cancer metastatic to the brain.

(Abstract presented at the 13th Annual Meeting of the Society for NeuroOncology, Las Vegas, Nevada, November 20-23, 2008.) *NeuroOncology* 2008; 10: 795.

## INVITED LECTURES



**1. Kasahara, N.**

Ligand-receptor mediated targeting of retroviral vectors.

(Cambridge Healthtech Institute 3rd Annual Meeting on Gene Therapy: New Technologies and Applications, Arlington, VA; May 1-3, 1995.)

**2. Kasahara, N., and Kan, Y. W.**

Tissue-specific retroviral vectors for gene therapy.

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